Ardupilot VSM User Guide

UgCS 2.5.242

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1 Ardupilot VSM User Guide

1.1 First time vehicle connection

See Disclaimer.

Please follow these steps to connect an Ardupilot vehicle to the UgCS:

1. Ardupilot vehicle must be properly configured, calibrated and tested using tools and instruction from the official `Ardupilot web site` prior to using it with UgCS. UgCS does not support initial configuration, setup and calibration of Ardupilot driven vehicles.
2. If more than one Ardupilot vehicle is planned to be used with UgCS, it must be ensured that each vehicle has a unique system id as defined by the parameter *SYSID_THISMAV*, otherwise UgCS will not be able to distinguish between different vehicles and it will not be possible to operate vehicles normally. To change the parameter, please use the official Ardupilot configuration software like Mission Planner.
3. Turn on the vehicle and plug in the radio modem paired with the vehicle or direct USB cable from the Ardupilot board to the computer where VSM is running. UgCS uses serial ports for communication with Ardupilot vehicles. Standard communication devices like 3DR radio modems (and their analogs) and direct USB connections are supported, as long as OS driver for virtual serial port is installed and serial port is successfully created. Please refer to your communication equipment manufacturer documentation about driver installation instructions.
4. Open *Vehicles* window in UgCS Client and wait until new vehicle appears there automatically. Both Uplink and Downlink connections should be available. Press *Gain control* and *Edit* to select corresponding vehicle profile and change the default vehicle name to be convenient for you:

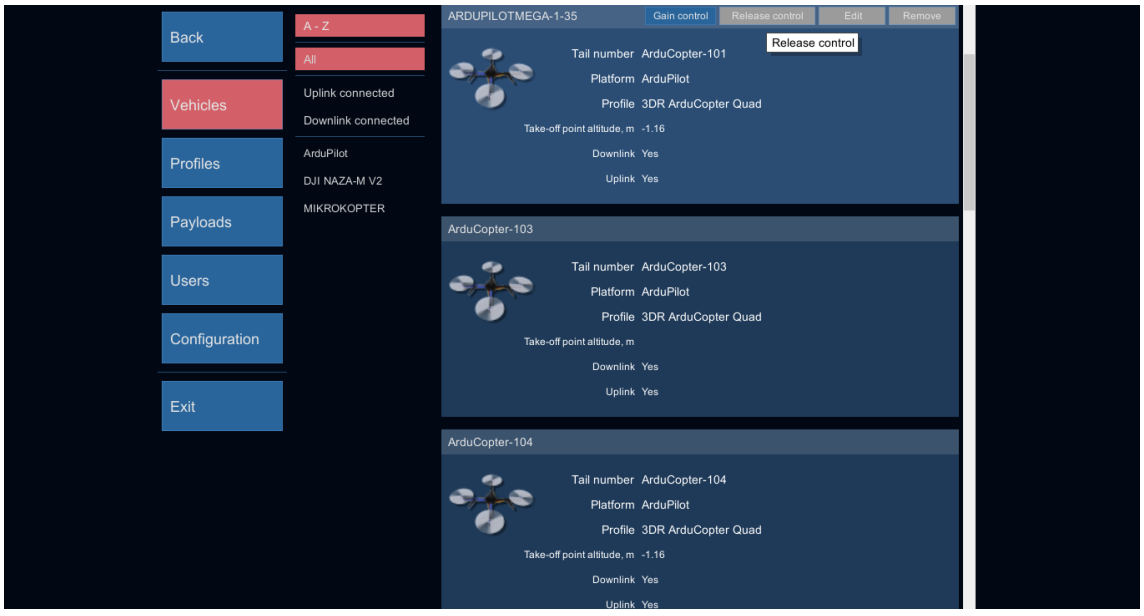

Figure 1: New Ardupilot vehicle

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Vehicle profile needs to be assigned to allow mission planning with this vehicle. Image needs to be assigned to see vehicle location on the map.

5. Repeat steps above for each your Ardupilot vehicle.

Supported vehicle types:

- Copters.

Supported Ardupilot firmware versions:

- 3.0
- 3.1.x
- 3.2.x (recommended)

Supported hardware platforms:

- APM
- Pixhawk

Note: Pixhawk with PX4 autopilot is not supported.

1.2 Mission execution specifics

Mission action support:

Flight plan element / action	Support	Notes
Change speed	Partial	Changing of flight speed during the mission is currently broken for Ardupilot due to firmware bugs.
Panorama	Partial	Only clock-wise movement is supported due to Ardupilot firmware bug. UgCS provides correct angle values according to Mavlink specification.
Set camera mode	Partial	Only photo mode is supported.
Set camera by time	Partial	"First shot delay" parameter is not supported.
Set camera by distance	Partial	Only "Distance" parameter is supported.

Camera control

For using camera you should set up necessary parameters in ArduPilot native software according to your hardware configuration. See also Camera control parameters

- VSM configuration should match your copter configuration. See ArduCopter manual for details.

For example, in MissionPlanner the camera set up can be done in "Initial setup" page "Optional hardware/Camera gimbal/Shutter" section. Select the channel your shutter is connected to and set other parameters depending on your shutter control hardware.

Home Location

Warning

Home location set via mission is ignored by Ardupilot.

Ardupilot will always override home location with current position at the time of arming.

When "RETURN_HOME" command is issued from UgCS Client or RC transmitter, vehicle will return to launch location regardless of home location set in mission.

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1.3 Command execution specifics

Command	Support	Notes
ARM	Yes	Arms vehicle.
DISARM	Yes	Disarms vehicle.
AUTOMODE	Yes	Sets *Auto* flight mode.
MANUALMODE	Yes	Sets *Loiter* flight mode.
RETURNHOME	Yes	Vehicle will return to launch location regardless of home location set in mission.
TAKEOFF	No	
LAND	Yes	
EMERGENCYLAND	No	

1.4 Command shading

UGCS Client can show command buttons in different shades. You can always press all buttons disregarding of shade. Highlighted buttons suggest recommended commands, depending on vehicle current status.

Command shading:

State	Button highlighted	Button shaded
Armed	DISARM, AUTOMODE, MANUALMODE, LAND, RETURNHOME	ARM
Disarmed	ARM	DISARM, AUTOMODE, MANUALMODE, LAND, RETURNHOME

1.5 Telemetry information specifics

Nothing specific.

1.6 Fail-safe actions

GPS Lost:

Action	Result
Wait	Aircraft tries to maintain altitude
Land	Aircraft lands even if in loiter mode

RC Lost:

Action	Result
Wait	Aircraft changes altitude to failsafe alt. (set via MissionPlanner) and returns home
Land	Aircraft lands even if in loiter mode
Return Home	Aircraft changes altitude to failsafe alt. (set via MissionPlanner) and returns home
Continue	Aircaft continues mission

Battery Low:

Action	Result
Wait	Aircraft changes altitude to failsafe alt. (set via MissionPlanner) and returns home

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Land	Aircraft changes altitude to failsafe alt. (set via MissionPlanner) and returns home
Return Home	Aircraft changes altitude to failsafe alt. (set via MissionPlanner) and returns home
Continue	Aircaft continues mission

1.7 Waypoint turn types

There are 2 different routing planning modes for Ardupilot autopilots: Straight waypoint and Spline waypoint. You can choose turn type for each Waypoint, Circle, Perimeter. The default turn mode in the system is Straight type.

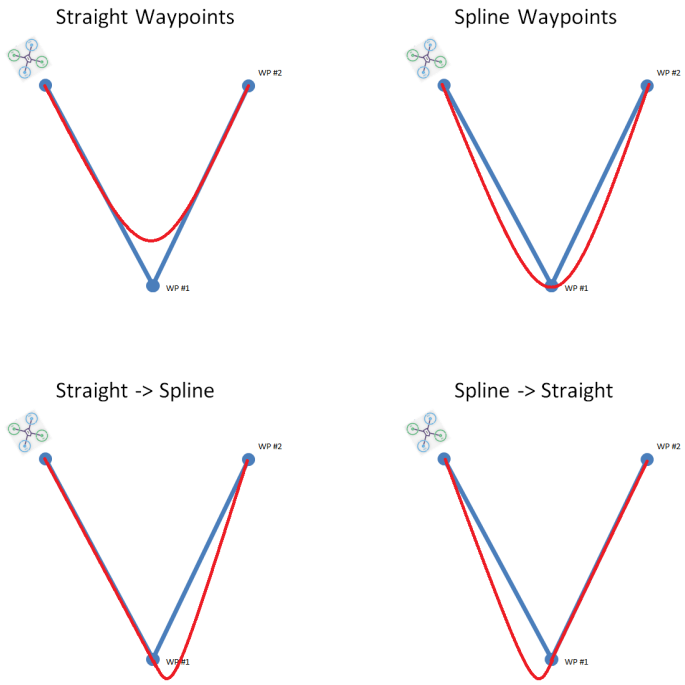

Figure 2: Turn type

Turn type	Support	Notes
Straight	Yes	The vehicle will fly a straight line to the location specified as a lat, lon and altitude.
Spline	Yes	The vehicle will fly to the location specified as a lat, lon and altitude, but when executed the vehicle will fly smooth paths (both vertically and horizontally) instead of straight lines.

You can find more information about turning mode and supporting autopilots on the site https://github.com/diydrones/apm_planner/issues/274, http://copter.ardupilot.com/wiki/mission-command-list/#spline_waypoint.

1.8 Configuration file

Default configuration file of the Ardupilot VSM suits most needs and it is generally not necessary to modify it.

Configuration file location:

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- **On Microsoft Windows:**

```
C:\Program Files (x86)\UgCS\bin\vsm-ardupilot.conf
```

- **On GNU/Linux:**

```
/etc/opt/ugcs/vsm-ardupilot.conf
```

- **On Apple OS X:**

```
/Users/[user name]/Library/Application Support/UGCS/configuration/vsm-ardupilot.conf
```

1.8.1 Common parameters

All VSMs share a common set of configuration file parameters described in Common configuration file parameters. Ardupilot VSM configuration file prefix is:

```
vehicle.ardupilot
```

1.8.2 Serial port configuration

Mandatory. At least one serial port should be configured, otherwise VSM will not try to connect to the vehicle.

- **Name:** vehicle.ardupilot.serial_port
- **Description:** Serial port configuration, for more details see Serial port configuration. Default Ardupilot serial port communication speed is 57600 bps.
- **Example:**

```
vehicle.ardupilot.serial_port.1.name = com1
vehicle.ardupilot.serial_port.1.baud = 57600
```

1.8.3 Model name and serial number override

Optional.

- **Name:** vehicle.ardupilot.custom.[name].system_id = [system id]
- **Name:** vehicle.ardupilot.custom.[name].model_name = [model name]
- **Name:** vehicle.ardupilot.custom.[name].serial_number = [serial number]
- **Description:** In UgCS each vehicle is identified by a unique combination of model name and serial number represented as text strings. By default, Ardupilot vehicles are identified with a model name *Ardupilot* and serial number equal with the Mavlink system id read from the vehicle. It can be overridden by these parameters, where [name] is an arbitrary vehicle name, [system id] is the original Mavlink system id which should be overridden, [model name] is a new model name to be visible to the UgCS, [serial number] is a new serial number to be visible to the UgCS.
- **Example:**

```
vehicle.ardupilot.custom.my_drone.system_id = 2
vehicle.ardupilot.custom.my_drone.model_name = ArducopterQuad
vehicle.ardupilot.custom.my_drone.serial_number = 123456
```

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1.8.4 Camera control parameters

Mandatory. Read Ardupilot manual about camera triggering configuration to understand these parameters. It is assumed that the vehicle is configured in "servo" mode (not "relay") for camera triggering.

- **Name:** vehicle.ardupilot.camera_servo_idx
- **Description:** Index of the servo to use for camera triggering.
- **Example:**

```
vehicle.ardupilot.camera_servo_idx = 8
```

- **Name:** vehicle.ardupilot.camera_servo_pwm
- **Description:** PWM value to set for camera triggering servo when taking photo.
- **Example:**

```
vehicle.ardupilot.camera_servo_pwm = 1900
```

- **Name:** vehicle.ardupilot.camera_servo_time
- **Description:** Time to hold camera servo at the specified PWM when triggering single photo in seconds.
- **Example:**

```
vehicle.ardupilot.camera_servo_time = 1.0
```

1.9 Common configuration file parameters

VSM configuration file is a text file specified via command line argument - *-config* of the VSM application. Example:

```
--config /etc/opt/ugcs/vsm-ardupilot.conf
```

Each configuration parameter is defined as a line in the configuration file with the following structure:

```
name1.name2....nameX = value
```

where name1, name2 ... nameX are arbitrary names separated by dots to divide a variable into logical blocks and a value which can be a number value or a text string depending on the context. See below the description about common VSM configuration parameters.

1.9.1 UgCS server configuration

1.9.1.1 Listening address

Mandatory.

- **Name:** ucs.local_listening_address = [IP address]
- **Description:** Local TCP address to listen for incoming connections from UgCS server. Specify *0.0.0.0* to listen from all local addresses.
- **Example:** ucs.local_listening_address = 0.0.0.0

1.9.1.2 Listening port

Mandatory.

- **Name:** ucs.local_listening_port = [port number]
- **Description:** Local TCP port to listen for incoming connections from UgCS server. Default is 5556.
- **Example:** ucs.local_listening_port = 5556

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1.9.2 Logging configuration

1.9.2.1 Level

Optional.

- **Name:** log.level = [error|warning|info|debug]
- **Description:** Logging level.
- **Default:** info
- **Example:** log.level = debug

1.9.2.2 File path

Optional.

- **Name:** log.file_path = [path to a file]
- **Description:** Absolute or relative (to the current directory) path to a logging file. Logging is disabled if logging file is not defined. File should be writable. Backslash should be escaped with a backslash.
- **Example:** log.file = /var/opt/ugcs/log/vsm-ardupilot/vsm-ardupilot.log
- **Example:** log.file = C:\\Users\\John\\AppData\\Local\\UGCS\\logs\\vsm-ardupilot\\vsm-ardupilot.log

1.9.2.3 Maximum single file size

Optional.

- **Name:** log.single_max_size = [size]
- **Description:** Maximum size of a single log file. When maximum size is exceeded, existing file is renamed by adding a time stamp and logging is continued into the empty file. [size] should be defined as a number postfixed by a case insensitive multiplier:
  - Gb, G, Gbyte, Gbytes: for Giga-bytes
  - Mb, M, Mbyte, Mbytes: for Mega-bytes
  - Kb, K, Kbyte, Kbytes: for Kilo-bytes
  - no postfix: for bytes
- **Default:** 100 Mb
- **Example:** log.single_max_size = 500 Mb

1.9.3 Serial port configuration

Optional. VSM which communicates with vehicles via serial ports should define at least one serial port, otherwise VSM will not try to connect to the vehicles. Port name and baud rate should be both defined. [prefix] is unique for each VSM.

1.9.3.1 Port name

Optional.

- **Name:** [prefix].[port index].name = [regular expression]
- **Description:** Ports which should be used to connect to the vehicles by given VSM. Port names are defined by a [regular expression] which can be used to define just a single port or create a port filtering regular expression. Expression is case insensitive on Windows. [port index] is a arbitrary port indexing name.
- **Example:** vehicle.ardupilot.serial_port.1.name = /dev/ttyUSB[0-9]+|com[0-9]+
- **Example:** vehicle.ardupilot.serial_port.2.name = com42

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1.9.3.2 Port baud rate

Optional.

- **Name:** [prefix].[port index].baud.[baud index] = [baud]
- **Description:** Baud rate for port opening. [baud index] is an optional arbitrary name used when it is necessary to open the same serial port using multiple baud rates. [port index] is an arbitrary port indexing name.
- **Example:** vehicle.ardupilot.serial_port.1.baud.1 = 9600
- **Example:** vehicle.ardupilot.serial_port.1.baud.2 = 57600
- **Example:** vehicle.ardupilot.serial_port.2.baud = 38400

1.9.3.3 Excluded port name

Optional.

- **Name:** [prefix].exclude.[exclude index] = [regular expression]
- **Description:** Ports which should not be used for vehicle access by this VSM. Port names are defined by a [regular expression] which can be used to define just a single port or create a port filtering regular expression. Filter is case insensitive on Windows. [exclude index] is a arbitrary indexing name used when more than one exclude names are defined.
- **Example:** vehicle.ardupilot.serial_port.exclude.1 = /dev/ttyS.∗
- **Example:** vehicle.ardupilot.serial_port.exclude = com1

1.9.3.4 Serial port arbiter

Optional.

- **Name:** [prefix].use_serial_arbiter = [yes|no]
- **Description:** Enable (yes) or disable (no) serial port access arbitration between VSMs running on the same machine. It is recommended to have it enabled to avoid situation when multiple VSMs try to open the same port simultaneously.
- **Default:** yes
- **Example:** vehicle.ardupilot.serial_port.use_serial_arbiter = no

1.9.4 Network connection configuration

Optional. VSM which communicates with vehicles via network should define at least one network connection, otherwise VSM will not try to connect to vehicles. [prefix] is unique for each VSM.

1.9.4.1 Local IP-address for UDP

Optional.

- **Name:** [prefix].detector.[con index].udp_local_address = [IP-address]
- **Description:** Local IP-address to listen for incoming UDP packets on. Specify 0.0.0.0 if you want to listen on all local addresses.
- **Example:** vehicle.ardrone.detector.1.udp_local_address = 0.0.0.0

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1.9.4.2 Local UDP port

Optional.

- **Name:** [prefix].detector.[con index].udp_local_port = [port number]
- **Description:** Local UDP port to listen for incoming packets on.
- **Example:** vehicle.ardrone.detector.1.udp_local_port = 14550

1.9.4.3 Remote IP-address for UDP

Optional.

- **Name:** [prefix].detector.[con index].udp_address = [IP-address]
- **Description:** Remote IP-address to send outgoing UDP packets to.
- **Example:** vehicle.ardrone.detector.1.udp_address = 192.168.1.1

1.9.4.4 Remote UDP port

Optional.

- **Name:** [prefix].detector.[con index].udp_port = [port number]
- **Description:** Remote UDP port to send outgoing packets to.
- **Example:** vehicle.ardrone.detector.1.udp_port = 14551

1.9.5 Mission dump path

Optional.

- **Name:** [prefix].mission_dump_path = [path to a file]
- **Description:** File to dump all generated missions to. Timestamp is appended to the name. Delete the entry to disable mission dumping. All directories in the path to a file should be already created.
- **Example:** vehicle.ardupilot.mission_dump_path = C:\\tmp\\ardupilot_dump

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